17.3: Data and Analysis

Data Collection

1. (Acquiring competencies) Following your detailed protocol based on the videos, perform all the experiments. Record your observations and take pictures of your key steps in the process. Your observations and images need to be incorporated in your data section and this section should be as detailed as possible as you will use this information to complete your discussion.
2. (Acquiring competencies) Follow the change in temperature until the ice is fully melted and the temperature doesn't go down any further. If this takes more than 15 minutes or the temperature goes below 4 ºC, start the experiment again with more water. You are encouraged to record your temperature values at specific time intervals (ex. every minute) to keep track of the amount of time that elapsed from the moment you put the ice in the water and the moment thermal equilibrium was established.
3. (Representation) Prepare a table for the data in experiment 1 showing the temperature after each minute. At 0 minutes it will have the temperature of the DI water in the cup.
4. (Representation) Prepare a table for the data in experiment 2 showing the temperature after each minute. At 0 minutes it will have the temperature of the DI water in the cup.

Data Processing

1. (Analysis) Looking at your data for experiment 1, identify the temperature at thermal equilibrium, which is the final temperature of your combined water and melted ice.
2. (Representation) On a piece of paper, draw a large heating curve for water in black ink. Label the y-axis as temperature, and the x-axis as heat added. Mark the freezing and boiling points for water on the temperature axis.
3. (Representation) The graph will look like a series of steps. Label each slanted line in black ink with the appropriate expression for finding the heat absorbed or released during a temperature change. Please, include the state of the substance for which the specific heat constant is used.
4. (Representation) For the horizontal lines, indicate the connected phases in black ink. Then, label each horizontal line with the expression for the heat evolved or absorbed in that phase change. Include any constants that are used.
5. (Representation) Mark the changes that the cooling of the water underwent in blue and the changes the ice underwent in red. They should meet in one point on the graph.
6. (Manipulation) Using your recorded masses, initial and final temperatures, and assuming that the melting ice was at 0.0ºC, calculate the enthalpy of fusion of ice.
7. (Analysis) Looking at your data for experiment 2, identify the temperature at thermal equilibrium, which is the final temperature of your combined water and melted ice.
8. (Representation) On a piece of paper, draw a large heating curve for water in black ink. Label the y-axis as temperature, and the x-axis as heat added. Mark the freezing and boiling points for water on the temperature axis.
9. (Representation) The graph will look like a series of steps. Label each slanted line in black ink with the appropriate expression for finding the heat absorbed or released during a temperature change. Please include the state of the substance for which the specific heat constant is used.
10. (Representation) For the horizontal lines, indicate the connected phases in black ink. Then, label each horizontal line with the expression for the heat evolved or absorbed in that phase change. Include any constants that are used.
11. (Representation) Mark the changes that the cooling of the water underwent in blue and the changes the ice underwent in red. They should meet in one point on the graph.
12. (Manipulation) Using your recorded masses, initial and final temperatures, assuming that the ice was originally at your freezer's temperature, the melting point of ice is 0ºC, and the enthalpy of fusion is 6.01 kJ/mol, calculate the specific heat of ice.
13. (Assumptions and Analysis) Fill in the following table using the observations and data from your experiments.

Assumptions made	Testing the assumption	If assumptions are wrong ...

Assumptions made	Testing the assumption	If assumptions are wrong ...
Ice melts at 0.0°C.	Freeze the water in the freezer and record the temperature when it melts.	
Ice from distilled water and tap water will have the same melting point.		